

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
4 March 2004 (04.03.2004)

PCT

(10) International Publication Number
WO 2004/018396 A1

- (51) International Patent Classification⁷: C07C 17/20, 17/21, 19/08, B01J 23/86
- (21) International Application Number: PCT/US2003/026324
- (22) International Filing Date: 21 August 2003 (21.08.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/405,223 22 August 2002 (22.08.2002) US
- (71) Applicants (for all designated States except US): E.I. DU PONT DE NEMOURS AND COMPANY [US/US]; 1007 Market Street, Wilmington, DE 19898 (US). NAPPA, Mario, J. [US/US]; 3 Oakridge Court, Newark, DE 19711 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): RAO, Velliyur, Nott, Mallikarjuna [US/US]; 1 Georgetown Avenue, Wilmington, DE 19809 (US). ROSENFELD, H., David [US/US]; 1927 Susquehannock Drive, Drumore, PA 17518 (US). SUBRAMONEY, Shekhar [IN/US]; 425 Stella Drive, Hockessin, DE 19707 (US). SUBRAMANIAN, Munirpallam, A. [US/US]; 20 Pratt Lane, Kennett Square, PA 19348 (US). SIEVERT, Allen, C. [US/US]; 215 Rhett Lane, Elkton, MD 21921 (US).
- (54) Title: PROCESS FOR THE PREPARATION OF 1,1,1,2,2-PENTAFLUOROETHANE
- (57) Abstract: A process for the preparation of pentafluoroethane is disclosed which involves contacting a mixture comprising hydrogen fluoride and at least one one starting material selected from haloethanes of the formula CX_3CHX_2 and haloethenes of the formula $CX_2=CHX_2$, where each X is independently selected from the group consisting of F and Cl (provided that no more than four of X are F), with a fluorination catalyst in a reaction zone to produce a product mixture comprising HF, HCl, pentafluoroethane, underfluorinated halogenated hydrocarbon intermediates and less than 0.2 mole percent chloropentafluoroethane based on the total moles of halogenated hydrocarbons in the product mixture. The process is characterized by the fluorination catalyst comprising (i) a crystalline cobalt-substituted alpha-chromium oxide where from about 0.05 atom % to about 6 atom % of the chromium atoms in the alpha-chromium oxide lattice are replaced by trivalent cobalt (Co^{+3}) and/or (ii) a fluorinated crystalline oxide of (i).
- (74) Agent: HEISER, David, E.; E.I. DU PONT DE NEMOURS AND COMPANY, LEGAL PATENT RECORDS CENTER, 4417 Lancaster Pike, Wilmington, DE 19805 (US).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:
- with international search report
 - before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 2004/018396 A1

BEST AVAILABLE COPY

INTERNATIONAL SEARCH REPORT

Int. Patent Application No.

PCT/03/26324

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C07C17/20 C07C17/21 C07C19/08 B01J23/86

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C07C B01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 641 598 A (SHOWA DENKO KK) 8 March 1995 (1995-03-08) claims	1,2
Y	EP 0 657 408 A (ATOCHEM ELF SA) 14 June 1995 (1995-06-14) claims	1,2
Y	EP 1 038 858 A (DAIKIN IND LTD) 27 September 2000 (2000-09-27) page 9, line 45; claims 1,2,10; example 3	1,2
Y	WO 98 10862 A (ICI PLC) 19 March 1998 (1998-03-19) page 7, line 1 - line 6; page 8, line 3 - line 5; claims 1-6	1,2
	--- -/--	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

° Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

4 December 2003

Date of mailing of the international search report

22/12/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Bonnevalle, E

INTERNATIONAL SEARCH REPORT

International Application No

PCT/03/26324

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 185 482 A (MANZER LEO E) 9 February 1993 (1993-02-09) claims 1-6 -----	1,2

BEST AVAILABLE COPY

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/03/26324

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0641598	A	08-03-1995	CA 2131361 A1	08-03-1995
			CN 1105951 A , B	02-08-1995
			DE 69415748 D1	18-02-1999
			DE 69415748 T2	19-08-1999
			EP 0641598 A2	08-03-1995
			GR 3029365 T3	28-05-1999
			JP 2996598 B2	11-01-2000
			JP 8038904 A	13-02-1996
			US 5494873 A	27-02-1996
EP 0657408	A	14-06-1995	FR 2713633 A1	16-06-1995
			AU 8034094 A	15-06-1995
			CA 2136938 A1	10-06-1995
			CN 1107827 A	06-09-1995
			DE 69406525 D1	04-12-1997
			DE 69406525 T2	07-05-1998
			EP 0657408 A1	14-06-1995
			ES 2110201 T3	01-02-1998
			GR 3025863 T3	30-04-1998
			JP 7206728 A	08-08-1995
EP 1038858	A	27-09-2000	JP 11171806 A	29-06-1999
			EP 1038858 A1	27-09-2000
			US 6433233 B1	13-08-2002
			WO 9931032 A1	24-06-1999
			US 6503865 B1	07-01-2003
WO 9810862	A	19-03-1998	EP 0925112 A1	30-06-1999
			WO 9810862 A1	19-03-1998
			JP 2001500059 T	09-01-2001
			US 2001011061 A1	02-08-2001
US 5185482	A	09-02-1993	US 5345016 A	06-09-1994
			AT 130593 T	15-12-1995
			AU 622295 B2	02-04-1992
			AU 5164990 A	24-08-1990
			BR 9007059 A	12-11-1991
			CA 2009189 A1	03-08-1990
			CN 1045091 A	05-09-1990
			DE 69023759 D1	04-01-1996
			DE 69023759 T2	20-06-1996
			EP 0455748 A1	13-11-1991
			ES 2080139 T3	01-02-1996
			JP 2695042 B2	24-12-1997
			JP 4503215 T	11-06-1992
			MX 170803 B	15-09-1993
			RU 2034822 C1	10-05-1995
			WO 9008755 A1	09-08-1990
			ZA 9000802 A	30-10-1991

BEST AVAILABLE COPY